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APPLICATION

FOR

UNITED STATES PATENT

TO ALL WHOM IT MAY CONCERN:

Be It Known That I:

DOUGLAS J. HIDDING

have invented new and useful improvements in

COLOR-CODED SHRINK WRAPPED CLOSURE SYSTEM

of which the following is a full,

clear and exact description.

TITLE

COLOR-CODED SHRINK WRAPPED CLOSURE SYSTEM

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to closure devices, and in particular, relates to a shrink-wrapped and injection molded tamper resistant bottle cap and neck for bottles which hold liquids, such as milk, water or juice, and a system for providing color-coded shrink-wrapped injection molded tamper resistant bottle cap and neck for bottles.

Injection molded caps for blow molded bottles (made of HDPE - high density polyethylene) have been used for many years. In addition, shrink wrapping bottle cap and necks has been used for many years. Generally, two types of bottle caps are available, push-on caps and thread-on caps. Push-on caps are installed by aligning the cap with the opening of a bottle and simply applying an axial force to the top of the cap. Thread-on caps generally require that the cap and bottle be aligned and that a rotational force be applied to the cap. In some cases, threaded caps, if carefully designed in conjunction with the bottle to which it is applied, can be made so that the rotational force required to install the cap is minimized or even eliminated. These kinds of injection molded caps are often made with polypropylene (both high and low density). Typically, caps on bottles sold to consumers include an integrally formed (i.e., injection molded) tamper-evident feature such as a an integrally molded ratchet ring on threaded caps, or one-time-use pull-tab on push-on caps..

A tamper evidencing ratchet ring has internal ratchet teeth that cooperate with matching teeth formed on the exterior of a bottle neck. When the bottle cap is screwed on the bottle neck, the ratchet teeth of the bottle cap ride over the mating ratchet teeth on the bottle neck, thereby enabling the bottle cap to be fully tightened on the bottle neck. However, when a user attempts to unscrew the bottle cap using low-to-medium twisting force, the ratchet teeth of the bottle cap positively engage the mating ratchet teeth of the bottle neck, thereby preventing unthreading and unsealing of the cap, unless the ratchet ring has been separated from the cap with which it was molded. Removal of the ratchet ring may occur when high levels of twisting force are applied to the bottle cap in the direction of unscrewing. The connection between the cap and the ratchet ring may be broken in this way, or by separately prying the ring from the cap. A broken connection between the ring and the cap, or the total absence of the ratchet ring from the bottle cap, serves as visual evidence that the bottle has been opened, and the contents may be contaminated. Furthermore, other tamper-evident and opening devices of bottle caps include a pull-tab that will create a tear in the plastic cap portion that extends over the bottle neck along the circumference of the cap, thus allowing the cap to be removed from the bottle, and in some cases allowing the torn portion to be removed from the cap. In the bottled water industry the pull tab on push-on caps for 5-gallon containers, for example, is not easily removable from the cap, and only partial tearing of the pull tab allows removal of the cap from the bottle.

While the combination of a bottle cap with a tamper evidencing ring and a bottle neck with ratchet teeth provides for an acceptable tamper-evident connection and seal, this combination does have its limitations. On occasion, these ratchet rings remain engaged by the ratchet teeth on bottle neck when the bottle is opened. When the contents of the bottle are poured into another container, the ratchet ring may become loose and can fall into the separate container

receiving the contents of the bottle. Furthermore, on smaller or single serving containers, the ratchet ring can become a nuisance as a consumer takes a sip directly from the bottle. If the ring has remained on the container after it has been opened, the ring may fall into the consumer's face or mouth as he or she is taking a sip.

Another way of providing evidence of tampering is to apply a shrink wrapped band at the interface between a cap and a bottle. This technique is commonly used on glass bottles containing liquids, such as juice, or other food product. See AXON® Corporation - Styrotech® of Raleigh, North Carolina, for an example of such shrink wrapping systems at http://www.axoncorp.com/heatshrink/, and U.S. Patent 5,165,215, entitled Machine for applying tamper evident bands to container. Commonly, the shrink sleeve or band is transparent. This allows the color and decorative features of the closure to be easily seen by consumers.

In the field of bottling and selling milk, bottlers have traditionally used different colored caps to differentiate one kind of milk from another. For example, red caps may be used to designate whole milk, light blue for skim milk, yellow for 1%, etc. Colored caps are also used to designate different kinds of juices or different flavors of beverages. Coordinating cap color with the contents of the containers, particularly when multiple kinds of beverage are bottled at a single facility or with a single bottling line, is no small task. In milk bottling facilities, a single filling line may be required to fill containers with four different kinds of milk. When changeovers from one kind of mild to another occur, all of the caps of one color in the capping portion of the filling line (e.g., feeder bowls and cap feeding chutes) must be removed and replaced with another color. In some cases the hoppers from which caps are fed are difficult to access and empty. These changeovers can require considerable time and effort to accomplish, and may be required to be done every day, or even multiple times a day.

Other problems associated with capping facilities using the typical capping system that relies upon cap color to differentiate the kind of milk in a container, include the fact that ample supplies of each color of cap must be kept on hand. This requires significant storage space and lead times in ordering different colored caps for the inventory. Using caps of several different colors complicates transportation and warehousing, and can result in delays in bottling operations.

Some larger retail grocery stores and large milk producers bottle milk at several sites, and service those sites from distribution centers, primarily from the standpoint of supplying inventory of caps and other supplies need in the bottling process. Capping facilities have for several years used different colored caps to differentiate products (e.g., skim, 1%, 2% and whole milk). This method of differentiation typically requires the bottler and/or the distribution center to store large amounts of colored caps - a 3 to 5 week supply on hand to facilitate change-over from one kind of milk to another on short notice. In such operations, colored caps may be ordered by a distribution center, then stored at the distribution center for later delivery to any one of several bottling facilities serviced by the distribution center. When a retailer decides what the "special" will be for a particular milk sale, i.e., skim, whole milk, 1% or 2%, it must then inform the bottling facility, which then must order the corresponding color caps from the distribution center and have them shipped to the bottling facility. Typically, a bottling/capping facility will order more caps of different colors and store them on site so they do not have to deal, on short notice, with a cap manufacturer in order to get the caps it need for a particular sale. The storage of caps will often take up large portion of floor space at the bottling facilities, as well as at the distribution center.

In order to eliminate many of the problems associated with capping systems now in place, the inventions disclosed and claimed herein, in a milk bottling application, allows a bottler to use caps of a single color, e.g., white or pigment-free, for all kind of milk, and then relies upon shrink sleeves or bands of different colors placed over the cap and neck of a bottle to differentiate one kind of milk from another. The cap and neck of a bottle are configured in such a way as to allow a mechanical interference between the shrink sleeve and both the cap and the bottle neck to help prevent the cap from backing off of a tightened position during shipment. By placing shrink sleeves of different colors on the bottle neck and by using cap of one standard color, a line change will entail a simple change in the color of shrink wrap is used rather than unloading and loading different colored caps from the feeder bowls and capping apparatus within the bottling line. By using different colored shrink wrapping sleeves, instead of different colored caps, warehouse and storage space is significantly reduced. The sleeves occupy considerably less space than do caps, and transportation costs (e.g., emergency shipments of colored caps) are diminished as no special transportation requirements for caps of a particular color will be required.

Using color-coded shrink sleeves over the cap and neck of a bottle significantly reduces costs associated with storing and disposing of large amounts of different colored caps, eliminates the problem associated with the ratchet ring dropping in milk glasses, reduces inventory space, reduces lead-time on ordering, and the tamper evident factor is clearly visual in shrink band. The caps are also interchangeable between several bottling facilities that may be serviced by a central distribution center.

The inventions described and claimed herein also have application in the field of bottled water, such as water that is transported and dispensed from inverted large (e.g., 5-gallon and 3-

gallon) containers. Consumers of bottled water have great concern about colorants used to give color to caps on containers of bottled water. Colorants may (or may be perceived to) affect the taste of water, since the plastic of caps for 5-gallon water bottles come into prolonged contact with the water that is stored therein. Yet, since the bottles themselves are reused over and over again the bottles cannot effectively be used for product identification. Instead, bottlers have traditionally used the cap and a label on the cap to provide some (albeit limited) product identification. By using a colored, multi-colored or printed shrink sleeves, instead of colored caps to identify the source of the bottled water, the bottlers can use caps that have no pigments or colorants. Similarly, when a bottler needs to differentiate one container from another (for example a container with a valved cap vs. a container with a standard unvalved cap), the bottler can simply use a shrink sleeve of one color for bottles with valved caps and a shrink sleeve of another color for bottles with standard unvalved caps. In the case of valved caps (which typically have a tamper-evident label covering the valve and at tamper-evident pull tab, the colored shrink sleeve will provide an additional layer of security in the form of a third level of tamper evidence.

For the foregoing reasons, there is a need for an improved tamper resistant bottle cap and bottle neck that limits the ability of a person to tamper with the contents of a bottle and provides a system for sealing the bottle cap and neck with a shrink wrap band. Specifically, there is a need for a tamper resistant bottle cap and bottle neck which will clearly show any tampering and will eliminate the ratchet ring of the previous art.

It is therefore a primary object of the inventions described and claimed herein is to provide an improved tamper resistant bottle cap and bottle neck for use in bottles which hold

liquids, such as milk and juice, and to provide a system for providing a shrink wrap band on the bottle neck and cap.

It is a further object of the inventions described and claimed herein to provide an improved tamper resistant seal between a bottle cap and a bottle neck in bottling operations that use the same kinds of containers to ship different products, such as different kinds of milk in 1-gallon containers.

It is another object of the inventions described and claimed herein to provide a system for color-coding a cap and bottle neck at a bottling/capping facility.

It is yet another object of the inventions described and claimed herein to provide a bottle neck with an improved durability sealing mechanism during transport of bottles of milk and juice.

The inventions described and claimed herein are directed to a tamper resistant bottle cap and bottle neck that satisfy the need for a bottle closure with an improved tamper resistant seal and color-coding system. A bottle closure having the features of the inventions described and claimed herein broadly comprises a bottle cap and a bottle neck.

The bottle cap of the inventions described and claimed herein includes a circular cover, a wide skirt depending from the periphery of the cover, and a tamper evidencing shrink wrap seal. The skirt of the bottle cap includes an interior surface having threads for retaining the cap to a bottle neck and an outer surface having a series of high and low knurls along its periphery.

The bottle neck of the inventions described and claimed herein includes an opening at its upper end, a cylindrical exterior surface having threads for retaining a bottle cap, a

circumferential bumper roll below the threads, and a circumferential portion below the bumper roll. The circumferential bumper roll has indentations on its underside.

The threads of the bottle cap and the bottle neck of the inventions described and claimed herein are appropriately dimensioned so as to sealingly engage when the bottle cap is screwed onto the bottle neck. After the bottle cap has been screwed onto the bottle neck, a shrink wrap band is applied to the bottle cap and bottle neck so as to prevent unscrewing of the bottle cap relative to the bottle neck without breaking the sealable connections. The tamper evidencing shrink wrap band of the bottle cap can be color-coded, clear or adapted to receive printing. The location of the indentations on the underside of the bumper roll and the knurls provides additional sealing means to the shrink wrap band of the combination of the bottle cap and bottle neck of the inventions described and claimed herein. Specifically, when the bottle cap is fully threaded onto bottle neck, the shrink wrap seal of the cap completely surrounds the skirt and partial portion of the top of the cap, so that it is very difficult to tamper with.

Brief Description of the Drawings

These and other features, aspects, objects, and advantages of the inventions described and claimed herein will be become better understood upon consideration of the following detailed description, appended claims and accompanying drawings where:

Figure 1 is a perspective view of a bottle cap and bottle neck made in accordance with the inventions described and claimed herein;

Figure 2 is a top view of a bottle cap and bottleneck made in accordance with the inventions described and claimed herein before placement of the shrink wrap band;

Figure 3 is a side elevational view of a bottle cap and bottle neck made in accordance with the inventions described and claimed herein;

Figure 4 is an enlarged view taken along line A-A in Figure 2;

Figure 5 is a top view of a bottle neck made in accordance with the inventions described and claimed herein;

Figure 6 is a side view of a bottle neck taken along line B-B in Figure 5;

Figure 7 is a side view of a bottle cap and bottle neck with a shrink wrap seal;

Figure 7A is a perspective view of the cap, neck and seal of Figure 7;

Figure 8 is a top view of a bottle cap and bottle neck with a shrink wrap seal.

Figure 9 is a perspective view of an alternative embodiment of the inventions described and claimed herein;

Figure 9A is a top view of the alternative embodiment of the bottle cap and neck in Figure 9;

Figure 9B is an enlarged view of the alternative embodiment in Figure 9 taken along line C-C in Figure 9A;

Figure 10 is a perspective view of a third alternative embodiment of the inventions described and claimed herein;

Figure 10A is a top view of the alternative embodiment of the bottle cap and neck in Figure 10;

Figure 10B is an enlarged view of the alternative embodiment in Figure 10 taken along line D-D in Figure 10A;

Figure 11 is a perspective view of a fourth alternative embodiment of the inventions described and claimed herein;

Figure 11A is a top view of the alternative embodiment of the bottle cap and neck in Figure 11;

Figure 11B is an enlarged view of the alternative embodiment in Figure 11 taken along line E-E in Figure 11A;

Figure 12 is a perspective view of a fifth alternative embodiment of the inventions described and claimed herein;

Figure 12A is a top view of the alternative embodiment of the bottle cap and neck in Figure 12;

Figure 12B is an enlarged view of the alternative embodiment in Figure 12 taken along line F-F in Figure 12A; and

Figure 13 is an illustration of a system in accordance with the inventions described and claimed herein.

It should be understood that the drawings are not necessarily to scale and that the embodiments are sometimes illustrated by graphic symbols, phantom lines, diagrammatic representations and fragmentary views. In certain instances, details which are not necessary for an understanding of the inventions described and claimed herein or which render other details difficult to perceive may have been omitted. It should be understood, of course, that the inventions described herein are not necessarily limited to the particular embodiments illustrated herein.

Like reference numerals will be used to refer to like or similar parts from Figure to Figure in the following description of the drawings.

Detailed Description of the Preferred Embodiments

Figures 1 and 3 generally depict the outside of a bottle cap and bottle neck of the inventions described and claimed herein. Figure 1 depicts the cap and neck combination in a perspective view, while Figure 2 illustrates a top view of a cap 11 and bottle neck 24 of the inventions described and claimed herein before a shrink wrap seal is placed on the bottle cap and neck. The cap 11 is comprised of a circular cover 12 and a depending skirt 14 with alternating high and low knurls 15 and 16, respectively, formed on the outside surface thereof (as shown more clearly in Fig. 4). Four distinct threads 26 are formed on the inside surface of the skirt 14.

Referring now to Figures 5 and 6 there is shown a bottle, indicated generally at 21, upon which the bottle cap 11 of the inventions described and claimed herein may be installed. The bottle 21 includes a body 22 and a cylindrical bottle neck 24 which is integral with the body 22. The bottle neck 24 has an upper opening 25 and an upper end 23 which terminates in an inwardly directed circumferential sealing lip 28 with an inner edge 29. The bottle neck 24 also includes four external screw threads 30 which engage threads 26 of bottle cap 11. The bottle neck 24 also includes a circumferential "bumper roll" or transfer ring 32 located immediately below the external screw threads 30 on the upper end 23 of the neck 24. In prior bottle neck designs, a bumper roll has been provided on a bottle neck for manufacturing purposes as it facilitates gripping the bottle during the loading of the bottle into a shipping container and is typically placed at a lower end 27 of the bottle neck 24. However, the bumper roll 32 of the bottle neck 24 of the inventions described and claimed herein may include additional features to provide even further advantages. It can be seen from FIGS. 3, 4 and 6 that bumper roll 32 includes a substantially flat annular top surface 34 and bottom surface 35. Preferably the top surface 34 and bottom surface 35 of the bumper roll 32 are parallel to each other and with respect

to a plane defined by the opening 25 of the bottle neck 24. Also, it is preferred that the top surface 34 of the bumper roll 32 is joined to the bottom of the screw threads portion and the bottom surface 35 of the bumper roll 32 is joined to the top of the lower end 27 of the bottle neck 24.

Furthermore, in the preferred embodiment, the bumper roll 32 includes indentations 36 on its bottom surface 35 along the entire length of its periphery. As seen in Figure 4, the indentations 36 are preferably placed along the bottom surface 35 of the bumper roll 32 every 12° along its circumferential periphery and are approximately 0.100 in. in width. The placement of the indentations 36 on the bottom surface 35 of the bumper roll 32 serves to increase gripping of the shrink wrap band.

The bottle neck 24 also includes a lower end 27 that extends from the bottom surface 35 of bumper roll 32 . As can be seen in FIGS. 1 and 3, the bumper roll 32 is diametrically larger than the screw threads portion of the neck 24 and the cap 11. The lower end 27 of bottle neck 24 is only slightly diametrically larger than the cap 11, but smaller than the bumper roll 32.

Specifically, in referring to FIGS. 7, 7A and 8, when bottle cap 11 is fully threaded onto bottle neck 24, the lower edge of skirt 14 of cap 11 is placed in contact with or closely adjacent to the top surface 34 of bumper roll 32, and the shrink wrap band 38 is placed around the bottle cap 11 and bottle neck 24 in its fully threaded position. The shrink wrap band 38 grabs the high and low knurls 15 and 16, respectively, on the outside surface of the skirt 14 of the cap 11, and shrinks to fit in between the alternating high and low knurls, 15 and 16, respectively, and further grabs the indentations 36 on the bottom surface 35 of the bumper roll 32, shrinking to fit into the indentations 36. The indentations 36 and high and low knurls 15 and 16, respectively, serve to

increase resistance and space for the shrink wrap band 38 to seal the bottle cap 11 and neck 24. The knurls and indentations 36 also provide a gripping means for the shrink wrap band 38 so that the band 38 does not slip circumferentially around the bottle cap 11 and neck 24. It also provides gripping means to sealingly engage the bottle cap 11 and neck 24 in such resistance that the combination does not allow for tampering without breaking the band 38 and such that the contents of the bottle 21 will not spill or leak out of the seal.

The bottle cap 11 of the inventions described and claimed herein is preferably clear or a solid white color. The shrink wrap band 38 is color-coded to correspond to the particular color needed to represent the contents of the liquid within in the bottle 21. For example, the shrink wrap band 38 can be a light blue color to indicate skim milk, or a light brown color to indicate chocolate milk, or a red color, to indicate a particular juice flavor. If multiple bottling lines are operated in a single facility, all of the beverage lines can use the same closure, and differentiation of the various beverages can be done primarily (or even exclusively) with color coded shrink sleeve material. The color-coding shrink wrap band 38 is provided in the machinery of the bottling/capping facilities and can be changed simply by changing the reel containing the colored shrink wrap material based on the needs at the time bottling/capping occurs. There is no need to remove caps from the feeder bowls typically used in capping operations, since a single kind of cap is all that is needed. Furthermore, the shrink wrap sleeves 38 are provided in the bottling facilities in the manufacturing process. The shrink wrap sleeves 38 are placed in a reel that can contain a plurality of different colored shrink wrap sleeves 38. The reel is similar to a movie reel and can simply be changed by pulling out one color and feeding another colored shrink wrap sleeve 38 into the reel. An example of such shrink wrap sleeve sealing can be found in U.S. Patent No. 5,165,215. One reel of shrink wrap sleeve material can service as many as 100,000

containers. Each shrink sleeve needs to be about 25 millimeters in axial length. The shrink sleeves 38 can be stored in larger quantities than different colored caps because the shrink wrap sleeve material comes ready-to use in boxes that are about 13 x 13 x 13 inches with each. The very compact shrink sleeve material can be relied upon to take the place of using different colored caps, which are much more bulky and space-consuming. This allows a bottler to use a single color of (or colorless) cap. In contrast, about 2000 caps having ratchet rings fit into a typical shipping container. Thus about 50 boxes of color coded caps would be required for 100,000 containers, whereas only one 13x13x13 inch box can be used for color coding the same quantity of containers.

Figures 9 to 12 illustrate alternative embodiments of the inventions described and claimed herein. Figure 9 illustrates an embodiment with bumps 40 placed along the outside circumferential periphery of the bumper roll 32 instead of the indentations 36 on the bottom surface 35 of the bumper roll 32 of the preferred embodiment. The bumps 40 are 0.115 inches in width and spaced with each bump's center point every 10° apart. Figure 10 illustrates bumps 40a, similar to those in Fig. 9, however, in this alternative embodiment, the bumps 40a are placed on the lower end 27 portion of the bottle neck 24 and have a diameter of 0.133 inches. The bumps 40a are positioned along the circumferential periphery of the lower end 27 of the bottle neck 24 with each bump's center point spaced every 10° apart. Figure 11 has protrusions 42 extending from the lower end portion 27 of the bottle neck 24 that are located directly below the bumper roll 32 where the bottom surface 35 of the bumper roll 32 meets the top edge 31 of the lower end portion 27 of the bottle neck 24. The protrusions 42 are 0.100 inches in width and are spaced every 15° apart along the circumferential periphery of the lower end portion 27.

Figure 12 illustrates another alternative embodiment that includes thirty-six (i.e. every 10 degrees) vertically oblong indentations 44 on the outermost surface of the bumper roll 32.

The advantages of the system of the inventions described and claimed herein in a large milk bottling operation with multiple bottling facilities can be seen in Figure 13. A centrally located distribution center 45 provides transportation and distribution services to a plurality of bottling facilities 46. Since a single standard cap is used for all grades of milk (i.e., skim, 1%, 2% and whole milk) the bottlers need only have one kind of cap on hand. The distribution center 45 may maintain a backup inventory, but again need only keep inventory of one standard cap (e.g., white or colorless). Since milk is shipped frequently from the bottling facilities to the distribution center 45, as milk is picked up by a truck for delivery to a distribution center 45, a supply of standard caps can be dropped off at each bottling facility 46 as part of regular runs. This eliminates the need for any special or costly transportation costs associated with specially colored caps for a particular sale that a retailer wants to have, e.g. a sale on skim milk. The system of the inventions described and claimed herein, eliminates the need for each bottling facility 46 to keep an inventory of several colors of caps, and avoids a similar problem at the distribution center 45. Indeed, standard shippers containing the standard caps used at all facilities can be ordered on a routine basis using "just-in-time" ordering and delivery, depending only on the overall volume of milk produced at the group of facilities, regardless of the kind or grade of milk produced.

In some instances, a bottler may rely entirely on the color-coded shrink sleeve to differentiate the contents of various containers containing different beverages, i.e., it may be possible that no other particularized labeling is necessary. However, even when an additional label descriptive of the particular contents of the container is applied (e.g., to the side of the

container), the color coded shrink sleeve, because of its visibility and prominent location allows the color-coded shrink sleeve to be the primary means for indicating to the consumer the kind of beverage in the container.

An additional benefit to bottlers that comes from the elimination of the ratchet ring on present caps is the fact the number of caps that can be shipped in the same size box is increased by approximately 167%, and there is no danger of a damaged ratchet ring (and consequent loss of tamper evidency), since there is no ratchet ring present in the cap which are part of the system described herein, and indications of tampering come from the shrink sleeve, instead of the ratchet ring.

The inventions described above with respect to caps used on beverages such as milk are also applicable to other bottle cap and neck configurations. For example, a color-coded shrink sleeve can be applied to 5-gallon containers (and containers other capacities having similar neck profiles) in the bottled water industry. The cap 50 in Figures 14-16 is an example of a valved cap of the kind commonly used on 5-gallon water bottles. Such bottles are typically made of clear polycarbonate or clear PET plastic (by an injection stretch blow-molding process) and are intended to be re-filled and re-used by water bottling companies. The cap 50 has a skirt 54 and an inner cap 62. A bead 58 provides the cap with an enlarged OD (outside diameter) at one end (the lower end in Figs. 14-16. The bead corresponds to a rounded annular upper portion 70 (Fig. 16) of the bottle 52 to which the cap is applied. While the cap shown in Figs. 14-16 is a valved cap with a protective label 60, the closure and color-coded systems of inventions described herein are also applicable to unvalved (or standard) 5-gallon closures, which do not have an inner cap 62, but may have a label 60. Also common on closures of the kind used for 5-gallon and other large capacity bottles is the inclusion of a pull tab (not shown) to facilitate the removal of

the cap when it is time to clean and refill the bottle upon return of the bottle to the bottling plant, although some bottlers have automatic cap removing machines or devices which do not rely on a pull tab.

As shown in Figures 14-16, a shrink sleeve 56 (about 44 mm in axial length) is applied to a cap 50 in phases. The first phase, shown in Figure 14, entails the initial application of an un-shrunk sleeve 56a. In Figure 14, a completely un-shrink 56a about to be placed over the cap 50 in the direction of the arrow 57. This may be a step that is performed by a cap manufacturer before the cap is applied to any bottle. If the cap maker applies the shrink sleeve in advance of the cap being applied to a bottle, the cap maker will preferably only partially shrink the sleeve such that there will be a gap 59 between the partially shrunk sleeve 56b and the skirt 54 of the cap 50. The gap 59 will allow radially outward flexing of the skirt of the cap as it is forced onto the top of a bottle without splitting the shrink sleeve. However, the partial shrinking of the sleeve will provide sufficient retention of the sleeve 56b on the cap 52 so that it may be handled, shipped and fed into a capping apparatus at the bottling facility.

Figure 15 shows the partially shrunk sleeve 56b and the gap 59 around the skirt of the cap. In Figure 15 the retention of the sleeve 56b on the cap 52 is provided by engagement of partially shrunk areas 66 and 68 with the bead 58 on the cap 52.

If the combination of a partially shrunk sleeve 56b and a cap 52, of the kind shown in Figure 15, is provided to a bottler by a cap maker, the bottler will preferably want to complete the shrinking of the sleeve 56b. The step of completing the shrinking of the sleeve to the condition shown in Figure 16 will be done by the bottler after the cap has been put onto the container 52. As can be seen in Figure 16, the fully shrunk sleeve 56c grips and is in substantial

contact with the exterior of the skirt 54, and the ends of the sleeve 56c cover the peripheral edge of the label 60.

As an alternative to the situation where the cap, as shown in Figure 15, comes to the bottler with a shrink sleeve 56b pre-applied by the cap maker, the bottler may want to do the installation of the shrink sleeve itself. In that case, the bottler will install a shrink sleeve application line and a heater to perform the shrinking. In this manner, the intermediate step of partially shrinking the sleeve will be eliminated. There may be some additional capital expenditure required by the bottler in this case, but it will afford the bottler with a greater flexibility when it comes to managing inventory, as discussed above in the case of milk bottling. Water is also marketed in various ways which may require differentiation in the same way that skim, 1%, 2% and whole milk require differentiation. For example, a botter may offer some or all of the following kinds of water: spring water, distilled water, fortified water (i.e., with fluoride), Artesian water, mineral water and baby water. Using one standard pigment-free cap for all of the types of water sold in combination with different colored shrink sleeves will allow the bottler to differentiate its products in a highly visible and colorful way, while also allowing the bottler to use only one kind of cap for all of its water products, thus benefiting from the inventory simplicity described above.

In the bottled water industry, cleanliness and purity (and the appearance thereof) are important features. In dispensers used to support and allow extraction of water from inverted 5-gallon (and other sized) containers, valved versions of caps are left on the container to allow inversion without worrying about spillage during the process of changing bottles. Thus, valved caps are inserted directly into the unit from which water is eventually dispensed and may come into contact with water that is eventually consumed. It is important, therefore, to keep the

exterior of valved cap as clean as possible. The exterior of the cap 50 of Figure 16 is substantially covered by the shrink sleeve 56c and the removable label 60 cover. This provides an additional level of cleanliness that is of value to bottlers and consumers. Thus, particularly for valved caps, which are inserted directly into dispensing machines and which, as a result, may come into contact with water that is eventually consumed, the additional cleanliness of a shrink sleeve is a valuable improvement.

The closures 40 of Figures 14-16 has a valve and a one-time-use (or non-reattachable) removable label, like the closure shown and discussed in U.S. Patent 5,904,259 (which is incorporated herein by reference). When such closures are used with the shrink sleeve as discussed herein the bottler and consumer are afforded a multi-faceted approach to tamper evidency. First the cap cannot be removed from the container without destroying the cap (or pulling the pull tab, not shown in Figs. 14-16). Secondly, the label which block access to the valve, cannot be removed and replaced because it is free of adhesive. Thirdly, the shrink sleeve provides an additional level of tamper evidency. Thus, the benefits of color coding and inventory simplification are in addition to the safety afforded by the use of a tamper evidencing shrink sleeve as described above.

Thus, it is seen that an improved tamper resistant bottle cap and neck are provided which satisfy the need for a bottle with an improved tamper resistant seal. The inventions described and claimed herein includes a bottle cap with an improved means for connecting and sealing the cap to a bottle, which limits the ability of a person to defeat the sealing action of the shrink wrap seal on the bottle cap and neck and which limits the leakage or spillage from a loose seal during transport.

Although the inventions described and claimed herein have been described in considerable detail with reference to certain preferred embodiments, one skilled in the art will appreciate that the inventions described and claimed herein can be practiced by other than the preferred embodiments, which have been presented for purposes of illustration and not of limitation. Therefore, the spirit and scope of the appended claims should not be limited to the description of the preferred embodiments contained herein.